This document includes the Section 5.0, Deck Machinery and Weapons Lubrication, of the Draft EPA “Weather Deck Runoff Characterization Analysis Report” published in 2003. The reference number is: EPA-842-D-06-006

DRAFT
Characterization Analysis Report
Weather Deck Runoff

Section 5.0 - Deck Machinery and Weapons Lubrication

2003

5.0 DECK MACHINERY AND WEAPONS LUBRICATION

Deck machinery and weapons lubrication includes aircraft elevators, buoy handling systems, fire assist vehicles, mine handling systems, recovery, assist, securing, and traversing (RAST) systems, ship's boats launching systems, stores handling systems, towing and mooring systems, and weapons systems. The aircraft elevators were assessed on CV/CVN 68 and LHD 1 Class vessels. Grease was found to contribute, in small amounts, to the deck runoff both inside and outside 12 nm for both classes of vessel. The buoy handling system was assessed on USCG buoy maintenance vessels (Wenzel *et al*., 2001a).

These vessels mainly work within 12 nm cleaning, inspecting, repairing, and preserving buoys. Grease and hydraulic fluid can be trapped within rough deck surfaces and contribute to the deck runoff within 12 nm by these vessels. The survey team determined that fire assist vehicles do not contribute to deck runoff (see Section 5.3). Mine handling systems were found to have the potential to contribute lubricating oil to deck runoff through residuals being trapped in rough deck surfaces. The RAST system has the potential to contribute to deck runoff within 12 nm when grease applied to traverse cables migrates to non-skid surfaces and becomes entrained in washwater, rainwater, green water, etc. Stores handling systems were evaluated on the AOE 6 and DDG 51 Class vessels only. For both vessel classes, residual amounts of general purpose cleaner and grease have the potential to contribute to deck runoff due to rainfall or heavy seas within 12 nm. The survey team determined that towing and mooring systems do not contribute to deck runoff (see Section 5.8). Finally, the weapons systems aboard the AOE 6, DDG 51, MCM 1 and WPB 110 Class vessels were evaluated. All weapon systems were found not to contribute to deck runoff with the exception of the 5"/ 54-caliber lightweight gun mount and Close-In Weapon System (CIWS). These gun mounts and close-in weapons systems are maintained using a cleaner/lubricant/ preservative that can contribute to deck runoff within 12 nm when the vessels are operating during heavy seas or rainfall. It is important to note that, depending on operating conditions (hot, cold, humid, or dry), the amount of grease that could contribute to deck runoff may vary greatly. As with any grease or lubricant that is exposed to the elements, changing weather conditions (especially high temperature) could affect the viscosity of the grease, and, therefore, the amount of grease that may fall to the deck (Wenzel *et al*., 2001a).

5.1 AIRCRAFT ELEVATORS

Aircraft elevators are used to move aircraft from the hangar deck to the flight deck. Elevator cables, rails, and stanchions are lubricated by hand using DOD-G-24508A, MIL-G-23549, MIL-G-18458B, and MIL-G-24139A grease (see Table 5-1) (Navy, 2000). These elevator components are partially exposed to the weather, so rain and wind may cause these lubricants to fall to the deck or water, contributing to deck runoff both inside and outside 12 nm.

5.1.1 CV/CVN 68 Class Petroleum, Oil, and Lubricants

For the CV/CVN 68 Class, four aircraft elevators transport aircraft between the hangar and flight deck levels. Each aircraft elevator is 4,000 ft^2 and is capable of transporting up to 3 aircraft at one time. All safety stanchions, locks, and cables are cleaned and lubricated by hand using MIL-G-23549, MIL-G-24139A, and MIL-G-18458B greases. The amount used depends upon the

maintenance action performed and the person performing the maintenance. Information gathered from the crew revealed an average usage of 2 gal to 5 gal of grease per elevator. The largest contributor to deck runoff resulting from the operation and maintenance of aircraft elevators is MIL-G-23549 grease used to lubricate the elevator's operating cables. Although 4 gal of grease are used to lubricate each elevator, only a small amount has the potential to wash off within 12 nm because it is partially sheltered by the vessel structure (Surgeon, 2001; Wenzel *et al*., 2001a).

5.1.2 LHD 1 Class Petroleum, Oil, and Lubricants

For the LHD 1 Class, two aircraft elevators transport aircraft between the hangar and flight deck levels. Elevator cables, safety stanchions, and rails are lubricated using MIL-G-23549, DOD-G-24508A, and MIL-G-18458B greases. As with the CV/CVN Class vessel, the amount of material used varies with the maintenance action performed, and the person performing the maintenance. However, information gathered from the crew revealed that an average of 2 gal to 5 gal of grease is applied quarterly to each elevator. Only a small amount has the potential to wash off within 12 nm during heavy seas or a rainfall event and contribute to deck runoff because the largest portion of cable is housed on the elevator engine that is internal to the ship (Surgeon, 2001, 2002;Wenzel *et al*., 2001a).

Information regarding the potential discharge materials for aircraft elevators is presented in the following table.

Table 5-1— Potential Discharge Materials for Aircraft Elevators

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
General Purpose Grease, MIL-G-23549	1.7E+03	Petroleum Hydrocarbons	—	Unknown	Unknown	Unknown
Multipurpose Grease, MIL-G-24139A	9.6E+01	Petroleum Hydrocarbons	—	Unknown	Unknown	Unknown
Wire Rope Grease, MIL-G-18458B	1.4E+02	Phosphorous (yellow)	7723140	Unknown	Unknown	None
		Petroleum carriers	—	Unknown	Unknown	Unknown
Grease, DOD-G-24508A	Unknown	Synthetic hydrocarbon	—	> 73	Unknown	Unknown
		Sodium nitrite	7632000	< 1.5	Unknown	None

Table 5-2—Narrative Parameters for Aircraft Elevators

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential exists
Hardness	None
Nutrients	None
Odor	Unknown-not evaluated
Oil and Grease	Potential exists, none observed
Pathogens	None
PH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Would not change
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

The need for the information in this table was not recognized at the time of the assessment. The information is based on survey team recollection and consensus.

5.2 BUOY HANDLING SYSTEMS

Buoy handling systems are found on USCG vessels that conduct buoy maintenance. Buoy maintenance includes cleaning, inspection, repairing and preservation. Buoys that are used for navigational and weather observation purposes are maintained both within and beyond 12 nm, with the majority of buoys inside 12 nm. Buoys, along with their sinkers and anchor chains, are raised from their position in the water and hauled on deck using cranes and cross-deck winches. The wire rope on the cranes and cross-deck winches is lubricated with MIL-G-18458B grease. MIL-H-17672D hydraulic fluid is used in the cranes and cross-deck winches. Through normal buoy operations, grease and hydraulic fluid are deposited on the deck (e.g., leaks) and contribute to deck runoff. Although the majority of this grease and hydraulic fluid is immediately cleaned up, some remains trapped in the rough deck surface and may contribute to deck runoff both inside and outside 12 nm (Wenzel *et al.*, 2001a).

Wire rope on the cranes and cross deck winches are lubricated with grease MIL-G-18458B. The hydraulic system supplying the cranes and winches uses Texaco Rando HD 32 hydraulic fluid MIL-H-17672D, NSN 9150-01-087-3510. The potential materials contributing to deck runoff are hydraulic fluid MIL-H-17672D and MIL-G-18458B. The potential exists for these oils and lubricants to enter surrounding waters. The grease would have to fall onto the deck and be subsequently washed overboard; the hydraulic hoses would have to experience a failure. The amount that has the potential to enter surrounding waters could not be quantified (Wenzel *et al.*, 2001a).

Table 5-3— Potential Discharge Materials for Buoy Handling

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
Wire Rope Grease, MIL-G-18458B	1.4E+02	Phosphorous (yellow)	7723140	Unknown	Unknown	None
		Petroleum carriers	—	Unknown	Unknown	Unknown
Hydraulic Fluid, MIL-H-17672D	Unknown	Petroleum distillates	—	Unknown	Unknown	Unknown

Table 5-4— Narrative Parameters for Buoy Handling

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Colloidal Matter	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential exists
Nutrients	None
Odor	Unknown-not evaluated
Oil and Grease	Potential exists, none observed
Pathogens	None
PH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Would not change
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

The need for the information in this table was not recognized at the time of the assessment. The information is based on survey team recollection and consensus.

5.3 FIRE ASSIST VEHICLES

The CV/CVN 68 Class vessels have three flight deck fire trucks onboard the ship and the LHD 1 Class vessels have two. The survey team determined that the operation and maintenance of this equipment does not have the potential to contribute to deck runoff because while they are physically located on the flight deck during air operations (outside 12 nm), they are stored and serviced in the forward portion of the hangar bay in the ground support equipment (GSE) area (Wenzel *et al*., 2001a; Surgeon, 2002).

5.4 MINE HANDLING SYSTEMS

The survey team conducted an assessment of the systems aboard an MCM 1 Class vessel. Topside equipment includes: four cable reel assemblies, five winch assemblies, three winch control stations, three outrigger booms, two cranes, three mine tensioner payout systems, and a mine neutralization system (MNS) remotely operated vehicle. A 55 gal drum of lubricating oil,

MIL-PRF-2105E, was carried onboard the vessel when underway to replenish the acoustic and magnetic cable reels and the stern crane. The bases of each of the three outrigger booms contained approximately 1 lb of water-resistant, general purpose MIL-G-24139A grease, that has the potential to contribute to deck runoff. In addition, the drive gear located on the acoustic cable reel was thinly coated with grease MIL-G-24139A. Finally, the hydraulically-operated cranes use MIL-H-17672D hydraulic fluid. Because the areas surrounding the base of these cranes and cable reels did not have containment devices to contain fluid, the potential does exist for constituents (hydraulic fluid MIL-H-17672D) to enter surrounding waters in the event of a spill resulting from a ruptured line or hose. Although these spills are not directly regulated by UNDS, the residual constituents trapped in the rough deck surface may contribute to deck runoff (Wenzel, 2000c).

The Navy has 14 MCM 1 Class vessels and 12 MHC vessels equipped with mine handling equipment. MIL-G-24139A grease is applied to the outrigger boom articulating pins. Each MCM 1 Class vessel has three booms; each boom contains approximately 1 lb of MIL-G-24139A grease. These pins are exposed to the weather and the potential exists for the grease to enter the water (Wenzel *et al*., 2001a).

Table 5-5— Potential Discharge Materials for Mine Handling Systems

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
Multipurpose Grease, MIL-G-24139A	Unknown	Petroleum hydrocarbons	—	Unknown	Unknown	Unknown
Hydraulic Fluid, MIL-H-17672D	Unknown	Petroleum distillates	—	Unknown	Unknown	Unknown
Lubricating Oil, MIL-PRF-2105	Unknown	Petroleum hydrocarbons	—	Unknown	Unknown	Unknown

Table 5-6—Narrative Parameters for Mine Handling Systems

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential exists
Hardness	Unknown-not evaluated
Nutrients	None
Odor	Unknown-not evaluated
Oil and Grease	Potential exists, none observed
Pathogens	None
PH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Would not change
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

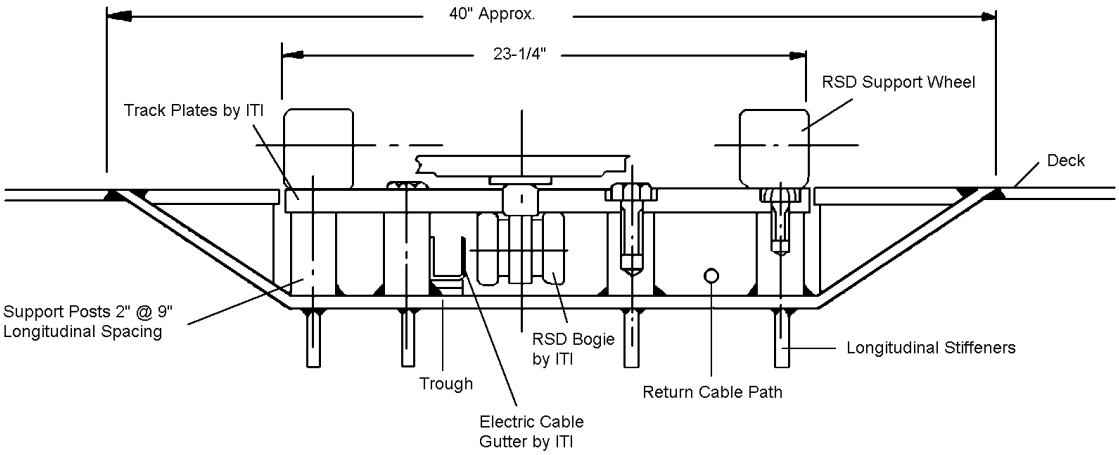
The need for the information in this table was not recognized at the time of the assessment. The information is based on survey team recollection and consensus.

5.5 RECOVERY, ASSIST, SECURING, AND TRAVERSING (RAST) SYSTEM

The recovery, assist, securing and traversing (RAST) system is designed for installation onboard vessels equipped with SH-60B helicopters. It is used to assist the helicopter to land safely on the flight deck, secure it immediately upon landing, safely transport it between the flight and hangar decks, and safely launch it during adverse weather conditions. Although the RAST system was not installed aboard DDG 51 Class vessels, it is installed on other vessels in the surface combatant category, (i.e., DD 963 (single and dual track), FFG 7, and CG 47 Class vessels). The survey team went aboard a CG 47 Class vessel to examine the RAST system and determine if it has the potential to contribute to deck runoff (Wenzel *et al*., 2001a).

The majority of the RAST system equipment is located below deck. Components located topside include the rapid securing device, electric cable reels, tail guide winch assembly, tracks, slot seals, and control console (See Figure 5-1). The rapid securing device (RSD) is housed inside the hangar bay while in port, and is moved to the flight deck only when necessary. If the RSD is moved to the flight deck when the vessel is in port, the RSD is covered with a form-fitting cover to prevent exposure to the environment. Track slot seals are installed in the traverse track slot to control the migration of water into the track during non-flight hours, between flight events when underway, when in port, and within 12 nm of shore (Wenzel *et al*., 2001a).

Figure 5-1. Cross Section of a Navy RAST System



The figure shows the trough for Navy RAST System. The trough is approximately 2 ft wide and 9 in deep. It acts as a guide for the Rapid Securing Device (RSD), and contains cables that are used to bring the helicopter to the deck and to move the helicopter along the track into the hangar. (Courtesy Indal Technologies Inc.)

The Navy has 98 vessels equipped with the RAST system. Because the assigned helicopters leave the vessel outside of the contiguous zone, the RAST system is not operated within 12 nm. As a result, only MIL-PRF-81322F grease applied to the traverse cables, located inside the tracks, and covered with slot seals, has a small potential to migrate to the non-skid surface and eventually contribute to deck runoff (Wenzel *et al*., 2001a).

The RAST system, used to assist helicopters to land safely on the flight deck of small platform vessels, is not used within the contiguous zone. The equipment uses MIL-PRF-81322F grease on the traverse cables, located inside the track covered with slot seals. Although the grease used is inside the track, the potential exists for grease to migrate to the non-skid surface and eventually contribute to deck runoff. The quantity that has the potential to enter surrounding waters could not be determined (Wenzel *et al*., 2001a).

Table 5-7— Potential Discharge Materials for Recovery, Assist, Securing and Traversing (RAST) system

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading	Any BCCs Present?
Grease, MIL-PRF-81322F	Unknown	Mixture of paraffinic, naphthenic, and aromatic hydrocarbons	—	Unknown	Unknown	Unknown

Table 5-8—Narrative Parameters for Recovery, Assist, Securing and Traversing (RAST) System

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential exists
Hardness	Unknown-not evaluated
Nutrients	None
Odor	Unknown-not evaluated
Oil and Grease	Potential exists, none observed
Pathogens	None
pH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Would not change
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

The need for the information in this table was not recognized at the time of assessment. The information is based on survey team recollection and consensus.

5.6 SHIP'S BOATS AND LAUNCHING SYSTEMS

Several vessel classes carry small boats that are used for various activities including lifeboats, law enforcement, supply transfers, and personal transfers. The boats are launched using either a crane or davit. The cranes or davits are connected to the boat by wire rope that is lubricated using various military standard greases including MIL-G-18458B and MIL-G-23549. The cables are also cleaned with MIL-PRF-680 Type III, a cleaning compound (Simple Green^{TM}), and JP-5 (MIL-DTL-5624T). Exposure to the rain and wind causes these lubricants to fall to the deck and contribute to deck runoff both inside and outside 12 nm. In addition, paint debris and residual hydraulic fluid from the cranes, fuels, soot, and cleaning compounds have the potential to become trapped in the rough deck surface and subsequently contribute to deck runoff discharge within the contiguous zone. Because the deck surfaces are cleaned outside 12 nm, only residual constituents will contribute to deck runoff within 12 nm.

In addition to the boat's launching systems, the engines of boats can be a source of deck runoff constituents. The engines of some of the smaller boats are run periodically on deck to ensure proper function. This operation deposits a mixture of constituents from the engine wet exhaust (e.g., fuel and soot) onto the deck of the vessel, creating the potential to contribute to deck runoff both inside and outside 12 nm.

5.6.1 AOE 6 Class

The AOE 6 Class carries six small boats that are equipped with Cummings engines, two 20 ft rigid hull inflatable boats (RHIBS), one 40 ft and one 50 ft fiberglass utility boats, one 35 ft aluminum work boat, and one 33 ft fiberglass captain's gig. All small boat engines are started

and operated weekly for a period of 15 min to 30 min to ensure they run correctly. Upon retrieval, following an operation, the bilges are checked to ensure there is no oil in the bilge before the bilge plug is removed and the boat is hoisted onboard. Bilgewater is visually inspected to determine if oil, fuel, or other contaminants are present. If contaminants are present, the bilgewater is collected and turned in to the HAZMINCEN for disposal ashore. If the visual inspection determines that the bilgewater appears free of oil and particulates, it is discharged directly overboard (Surgeon, 2001). The small boats are removed from the vessel and painted only when in port, except for minor touch-up painting. All small boats are cleaned with a solution of 1 cup MIL-D-16791G general purpose detergent mixed with 5 gal of freshwater, which drains directly overboard, followed by a freshwater rinse. The constituents that have the potential to contribute to deck runoff include the detergent/water mixtures used to clean the boats, paint debris from minor touch-up painting (a drop cloth is used during painting activities to minimize this), and small boat engine wet exhaust resulting from the weekly onboard operations (Wenzel, 2000e).

The captain's gig and utility boats are retrieved and deployed using a double arm, pivoting, gravity davit that contains two drums housing 0.75 in wire rope. A boat-lifting boom that contains one drum of wire rope 125 ft in length is used to raise and lower the RHIB's. The cables are cleaned using MIL-DTL-5624T (JP-5) and lubricated with MIL-G-18458B wire rope grease. Prior to conducting maintenance, a drop cloth is spread on the deck to contain the cleaning compound and greases. The contributing constituents to deck runoff from the vessels' boats launching system are MIL-G-18458B and MIL-DTL-5624T (Wenzel, 2000e).

5.6.2 DDG 51 Class

The DDG 51 Class has two 24 ft RHIBS equipped with a diesel inboard/outboard engine, which uses MIL-DTL-5624T (JP-5) fuel. The RHIBS are removed from the vessel and taken to an intermediate maintenance facility for painting (Navy, 1998). However, the crew performs minor repairs to the fiberglass hull. When the RHIB is hoisted on board after operations, the bilge pump is disabled and residual bilgewater is wiped-up with a sponge and deposited in a bucket. The contents of the bucket are then emptied into a deep sink that drains to the vessels' graywater tank. The hull is cleaned with freshwater and general-purpose detergent. The survey team concluded that there is minimal potential of topside contamination from the RHIBS, as evidenced by the cleanliness of the deck area immediately below the boats (Wenzel, 2000b).

One electro/mechanical slewing arm davit (SLAD) with 110 ft of 0.75-inch wire cable is used to launch and recover the RHIBS. The cable is manually cleaned, on an annual basis, using 2 gal to 3 gal of MIL-PRF-680 Type III dry cleaning solvent and lubricated with 1 lb of MIL-G-23549 grease. A drop cloth is spread on the deck prior to conducting the maintenance in an effort to contain the materials and prevent the hazardous constituents from coming into contact with the deck. Because the wire cable is exposed to the environment, it is possible that some of the of MIL-G-23549 grease may drip from the cable to the deck under certain conditions, such as extreme temperature or rainfall (Wenzel, 2000b).

5.6.3 MCM 1 Class

Each MCM maintains two 17 ft 10 in RHIBS. Two MCM 1 Class vessels were assessed by the survey team. One vessel had two RHIBs equipped with a 90 hp and a 60 hp outboard engine,

respectively. The second MCM 1 Class vessel had two RHIBS, each with a 90 hp outboard engine. The RHIBS are refueled using 6 gal gas cans filled from the 30 gal motor gasoline tank located on a jettison platform. The jettison platform is surrounded by a containment device and equipped with a plug and lanyard, that allows the crew to drain the containment device as needed. The outboard engines are operated daily for 2 min to 3 min, or as long as 15 min, at the discretion of the vessel's crew. The external surfaces and the bilge of the RHIBS are washed down with freshwater and a cleaning compound (Simple Green™) following every use and during major vessel cleanings. The primary constituents that have the potential to contribute to deck runoff are: (1) fuel residue from gasoline spilled when refueling the RHIB onboard vessel; and (2) contaminants resulting from the onboard operation of the outboard engines on a daily basis (Wenzel, 2000c).

One anti-magnetic electric hoist winch type BE-09 with a 1 in nylon rope with a lifting capacity of 2,000 lb is used to launch and recover the RHIBS. The nylon rope is static tested at twice the lifting capacity and operational testing is performed during the actual hoisting of the RHIBS. All load testing is performed by an outside activity when in port. The nylon rope is cleaned using freshwater. The nylon rope does not require lubrication and therefore would not contribute to deck runoff. The hoist assembly is cleaned with freshwater and a cleaning compound (Simple Green™) (Wenzel, 2000c).

5.6.4 WLM 175 Class

The WLM 175 Class vessel assessed had one 18 ft RHIB with a Yanmar four-cylinder engine and a Hamilton Jet inboard/outboard. The RHIB refueling station is enclosed by a 12 in high containment barrier. The RHIB is washed down following every use and during major vessel cleanings using a cleaning compound (Simple Green™). The primary constituent with the potential to contribute to deck runoff is residue from diesel fuel spilled during fueling operations and/or leaking fuel system fittings on the power plant (Wenzel, 2000a).

One Allied D6000 articulating crane with 0.5 in galvanized steel cable is used to launch and recover the RHIB from surrounding waters. The galvanized steel cable is greased using MIL-G-18458B. The hydraulic fluid used in the crane is Texaco Rando HD 32 hydraulic fluid (MIL-H-17672D). The primary constituent that contributes to deck runoff from vessel's boats launching systems is Texaco Rando HD 32 (Wenzel, 2000a).

5.6.5 WPB 110 Class

The WPB 110 Class carries one 17 ft RHIB with a 90 hp outboard engine with a through-prop exhaust system. The RHIB is refueled using gasoline supplied from 6 gal cans. Two 6 gal cans of gasoline and one 2.5 gal can of Shell 30W motor oil are maintained inside the RHIB and eight 6 gal cans of gasoline are maintained topside. The crew washes down the RHIB following every use and during major vessel cleanings using a cleaning compound (Simple Green™). The crew places a cover over the RHIB when the vessel is in port to protect it from the elements. The engine on each RHIB is operated for 2 min to 3 min each time the RHIBS are brought onboard (approximately 15 times a month). The primary constituents that have the potential to contribute to deck runoff are: (1) residue from gasoline spilled when refueling the RHIB onboard vessel; and (2) contaminants resulting from the onboard operation of the outboard engines on a daily basis. Small boat engine wet exhaust will be addressed separately under UNDS (Wenzel, 2000d).

One Electro/Hydraulic Sealift Appleton Marine Crane with 0.75 in cable is used to launch and recover the RHIB from surrounding waters. This crane uses NAPA Dextron III hydraulic fluid with a normal operating pressure of 1,800 psi, supplied from the crane's 15 gal reservoir located below deck. The crane has a lifting capacity of 1,750 lb. A cover is placed over the crane while the vessel is in port to protect the equipment from the weather and reduce corrosion. The cable is cleaned using MIL-PRF-680Type III and greased using MIL-G-18458B. A tarp is spread on the weather deck prior to cleaning and greasing the cable to contain the materials. The crane cable is lubricated with MIL-G-18458B and contributes to deck runoff (Wenzel, 2000d).

5.6.6 Summary of Petroleum, Oil, and Lubricants for Ship's Boats and Launching Systems

All of the vessels that were surveyed carried small utility and transport boats. The following table details the vessel class, number and types of boats, power plant and potential contributing constituents from ship's boats.

Table 5-9— Potential Ship's Boats Constituents by Vessel Class

Vessel Class	Boat Type	Number Onboard	Power Plant /Fuel	Potential Contributing Constituents
AOE 6	20 ft RHIB*	2	Diesel	JP-5/Diesel fuel MIL-DTL-5624T
AOE 6	40 ft Utility	1	Diesel	JP-5/Diesel fuel MIL-DTL-5624T
AOE 6	33 ft Captains Gig	1	Diesel	JP-5/Diesel fuel MIL-DTL-5624T
AOE 6	50 ft Utility	1	Diesel	JP-5/Diesel fuel MIL-DTL-5624T
AOE 6	35 ft Work Boat	1	Diesel	JP-5/Diesel fuel MIL-DTL-5624T
DDG 51	24 ft RHIB	2	Diesel	JP-5/Diesel fuel MIL-DTL-5624T
MCM 1	17 ft RHIB	2	Gasoline Outboard	Gasoline/outboard oil mixture 50:1 (portable fuel containers) Gas/oil/water exhaust on deck during test/maintenance runs
WLM 175	18 ft RHIB	1	Gasoline Outboard	Gasoline/outboard oil mixture 50:1 (portable fuel containers) Gas/oil/water exhaust on deck during test/maintenance runs
WPB 110	17 ft RHIB	1	Gasoline Outboard	Gasoline/outboard oil mixture 50:1 (portable fuel containers) Gas/oil/water exhaust on deck during test/maintenance runs

**Rigid-Hull Inflatable Boat*

The potential exists for residuals from leaking or spilled fuel to contribute to deck runoff. This fuel could be either MIL-DTL-5624T or the gasoline/oil mixture for the outboard motors. Because the fuel tanks for the JP-5/diesel powered boats are permanent tanks with hard-piped connections, it would require a system failure to cause a significant leak or a spill. The outboard

motors, which use portable fuel canisters plumbed with rubber hose to the engine, have a greater potential to leak than the hard-piped systems (Wenzel *et al*., 2001a).

The maintenance/test runs for the outboards are conducted on deck. The outboards have through prop exhaust systems that discharge the engine cooling water and any residual gasoline/oil from the combustion process. Small boat engine wet exhaust is addressed separately under UNDS (Wenzel *et al*., 2001a).

Table 5-10— Potential Discharge Materials for Ship's Boats

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
Fuel, MIL-DTL-5624T	Unknown	Kerosene	8008206	100	Unknown	Unknown
Detergent, MIL-D-16791G	Unknown	Nonylphenoxy (ethylenoxy) ethanol	—	> 99	Unknown	None
Gasoline/outboard oil mixture 50:1	Unknown	Unknown	—	Unknown	Unknown	Unknown
Soot from engine combustion	Unknown	Unknown	—	Unknown	Unknown	Unknown
Cleaning Compound (Simple Green™)	Negligible	2-butoxyethanol	111762	< 6	Negligible	None

A full analysis was not conducted on soot, but may contain carbonaceous material, sulfates, and by-products of incomplete combustion of fuel.

Table 5-11— Narrative Parameters for Ship's Boats

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential exists, none observed
Hardness	Unknown-not evaluated
Nutrients	None
Odor	Unknown-not evaluated
Oil and Grease	Potential exists, none observed
Pathogens	None
PH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Would not change
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

The need for the information in this table was not recognized at the time of assessment. The information is based on survey team recollection and consensus.

The launching systems for small boats varied in design and materials used for maintenance. The table below details the vessel class, type of launching system, and materials used.

Table 5-12— Potential Ship's Boats Launching Systems Constituents by Vessel Class

Vessel Class	Launching System	Material Used
AOE 6	Double arm, pivoting, gravity davit with 0.75-inch wire rope	MIL-G-18458B grease MIL-DTL-5624T (to clean the cable)
DDG 51	Electro/mechanical slewing arm davit With 0.75-inch wire cable	1 lb. MIL-G-23549 grease 2-3 gal MIL-PRF-680 Type III (to clean the cable)
MCM 1	Anti-magnetic electric hoist with nylon line	None
WLM 175	Articulating crane with 0.5-inch galvanized steel cable	MIL-G-18458B grease Texaco Rando HD 32 used in crane (MIL-H-17672D)
WPB 110	Electro/hydraulic marine crane with 0.75-inch cable	MIL-G-18458B grease MIL-PRF-680 Type III (to clean the cable) NAPA Dextron III hydraulic fluid

Note: The crew onboard the AOE 6 and DDG 51 stated that they spread a tarp on the deck prior to performing maintenance to contain the cleaning compound and grease. The potential exists for some of the grease applied to the cables exposed to the environment to be washed off during a rainfall event and enter surrounding waters.

Table 5-13— Potential Discharge Materials for Ship's Boats Launching Systems

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
Wire Rope Grease, MIL-G-18458B	Unknown	Phosphorous (yellow)	7723140	Unknown	Unknown	None
		Petroleum carriers	—	Unknown	Unknown	Unknown
General Purpose Grease, MIL-G-23549	Unknown	Petroleum Hydrocarbons	—	Unknown	Unknown	Unknown
Hydraulic Fluid, MIL-H-17672D	Unknown	Petroleum distillates	—	Unknown	Unknown	Unknown
Dry Cleaning Solvent, MIL-PRF-680 Type III	Unknown	High purity hydrocarbon solvents	—	100	Unknown	Unknown
Cleaning Compound (Simple Green™)	Negligible	2-Butoxyethanol	111762	<6	Negligible	None
Fuel, MIL-DTL-5624T	Unknown	Kerosene	8008206	100	Unknown	Unknown

Table 5-14— Narrative Parameters for Ship's Boats Launching Systems

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential exists
Hardness	Unknown-not evaluated
Nutrients	None
Odor	Unknown-not evaluated
Oil and Grease	Potential exists, none observed
Pathogens	None
PH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Would not change
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

The need for the information in this table was not recognized at the time of the assessment. The information is based on survey team recollection and consensus.

5.6.7 Painting and Preservation

Navy and USCG vessels carry small boats ranging in size from dinghies to utility boats. These craft are used to support the ship's mission (e.g., at-sea boardings and rescues, deployment and recovery of special ops teams, liberty launches and captains gigs) and are not capable of making independent voyages on the high seas. Most boats are built of aluminum, plastic, or fiberglass, while a small minority are made of wood. Rigid-hulled inflatable boats (RHIBS) are constructed of rubberized fabric pontoons with fiberglass hulls.

As previously discussed, Navy boats are removed from the vessel and taken to a shore intermediate maintenance facility for painting and hull repair. USCG boats are removed from the vessel and refurbished by an intermediate facility or contractor. If Navy boats require minor touch-up, the paint is removed using sand paper and/or a wire brush. A drop cloth is typically spread on the deck under the work area during paint removal and subsequent repainting. Following the repainting process, the work area is swept and vacuumed (if required); all paint debris is containerized and turned in to the HAZMINCEN for disposal ashore (Wenzel *et al*., 2001a).

Each vessel maintained their boats in a similar manner. Below is a listing of vessels that the survey team observed, the boats carried onboard, and typical boat maintenance procedures.

Table 5-15—Boat Maintenance Procedures

Vessel Class	Boat Type	Number Onboard	Boat Maintenance Procedures
AOE 6	20-ft RHIBS 50-ft utility boat 40-ft utility boat 35-ft work boat 33-ft Captain's gig	2 1 1 1 1 1	All boats are removed from the vessel and taken to the Shore Intermediate Maintenance Facility for painting. Minor touch-up painting (using brushes) is occasionally performed underway at distances greater than 12 nm
DDG 51	24-ft RHIBS	2	The RHIBS are removed from the vessel and taken to the SIMA Shore Intermediate Maintenance Facility for painting and hull repair.
MCM 1	17 ft 10 in RHIBS	2	The RHIBS are removed from the vessel and taken to the Shore Intermediate Maintenance Facility SIMA for painting and hull repair.
WLM 175	18 ft RHIB	1	The RHIB is removed from the vessel and refurbished by the Maintenance Augmentation Team (MAT).
WPB 110	17 ft RHIB	1	The RHIB is removed from the vessel and refurbished by the MAT.

5.6.8 Cleaning Compounds

MIL-D-16791G general purpose detergent is used to clean the small boats onboard the AOE 6 and DDG 51 Class vessels. All other vessels surveyed reported using small amounts of a cleaning compound (e.g., Simple Green™). Cleaning was accomplished using a sponge or rag. Bilges and exterior surfaces were wiped clean. The survey team concluded that while cleaners were used in this process, the amounts were insignificant and could not be quantified (Wenzel *et al*., 2001a).

5.7 STORES HANDLING SYSTEMS

Information on equipment used to handle and transfer stores was obtained during the AOE 6 and DDG 51 assessments only. AOE 6 Class vessels have four very large stations used for replenishment-at-sea operations. Each station is comprised of kingposts, winch engines, wire rope and cable drums with sheaves and control systems. The DDG 51 surveyed was equipped with receiving stations for replenishment at sea consisting of a kingpost, easing-out-cleat, and easing-out-stabilizer. Although underway replenishment operations are conducted outside 12 nm, the potential exists for the grease (MIL-G-24139A and MIL-G-23549C) to be washed-off within 12 nm by rainwater, green water, or washwater. The conditions that could cause a portion of the grease to fall from the kingpost to the weather deck include extreme temperature and rainfall. Residual amounts of grease left on the deck could contribute to deck runoff. The quantity that has the potential to enter surrounding waters could not be quantified (Wenzel *et al*., 2001a).

Figure 5-2. Underway Replenishment (UNREP) Transfer of Stores

UNREP transfer of stores. Transfer from AOE 6 to hangar deck of CVN 73.
(Navy photograph by Bobbie G. Attaway)

Figure 5-3. UNREP Replenishment at Sea (RAS) Kingpost with Sliding Padeye

UNREP Replenishment At Sea (RAS) Kingpost with sliding padeye on 01 Level. AOE 3
(Photograph courtesy of Deepak Saha, M. Rosenblatt & Son – an AMSEC LLC Group)

5.7.1 AOE 6 Class

The stores transfer system consists of four replenishment-at-sea (RAS) stations. The RAS stations consist of a kingpost assembly and four winches that provide and control the cable required for highline transfer of stores. Each of the winches contain differing lengths and sizes of wire rope: (1) 900 ft of 1-in wire rope, (2) 900 ft of 0.75 in wire rope, (3) 700 ft of 0.75 in wire rope, and (4) 1,200 ft of 0.5 in wire rope. Each winch station is lubricated with approximately 5

gal of MIL-G-24139A general purpose grease. Each winch engine contains engine oil and hydraulic fluid. Each RAS station is lubricated with approximately 10 gal of the same grease. Although underway replenishment operations are conducted outside 12 nm, the potential exists for the grease to be washed-off during rainfall within 12 nm. Residual engine oil and hydraulic fluid from the winch engines also have the potential to become trapped in the rough deck surface and contribute to deck runoff (Baillargeon, 2001). The crew reported that the MIL-G-24139A grease on the kingpost also "sloughed-off" when exposed to the high temperatures in the Persian Gulf (Wenzel *et al*., 2001a).

5.7.2 DDG 51 Class

Two kingpost sliding padeyes are located amidships: one port and one starboard. The sliding padeye is used to transfer materials between vessels during underway replenishment operations, which are never conducted within 12 nm. Each sliding padeye is comprised of a stanchion with a 25 ft lead screw assembly, an easing-out cleat, and an easing-out stabilizer. Because the kingpost's lead screw is exposed to the environment, the estimated 1 qt of MIL-G-23549 grease (per padeye) may contribute to deck runoff, under certain conditions. The conditions under which a portion of the grease could be transferred from the kingpost to the weather deck include extreme temperature and/or rainfall (Wenzel, 2000b).

5.7.3 Summary of Petroleum, Oil, and Lubricants for Stores Handling Systems

AOE 6 Class vessels have four very large stations used for replenishment-at-sea operations. Each station is comprised of kingposts, winch engines, wire rope, and cable drums with sheaves and control systems. The DDG 51 surveyed was equipped with receiving stations for replenishment at sea consisting of a kingpost, easing-out-cleat, and easing-out-stabilizer. The materials used to lubricate the stores handling systems are listed below (Wenzel *et al*., 2001a).

Table 5-16— Potential Stores Handling Systems Constituents by Vessel Class

Vessel Class	Equipment	Potential Discharge Material	Amount
AOE 6	900 ft 1 in wire rope	Grease, MIL-G-24139A	5 gal
AOE 6	900 ft 0.75 in wire rope	Grease, MIL-G-24139A	5 gal
AOE 6	700 ft 0.75 in wire rope	Grease, MIL-G-24139A	5 gal
AOE 6	1200 ft 0.5 in wire rope	Grease, MIL-G-24139A	5 gal
AOE 6	Kingpost Assembly	Grease, MIL-G-24139A	10 gal
DDG 51	Kingpost/Sliding Pad-Eye Assembly	Grease, MIL-G-23549	0.25 gal

The DDG 51 receiving station does not have a containment structure around the kingpost assembly. Because the grease is continuously exposed to the elements, it presents significant potential to contribute to deck runoff if the grease washes off the lead screw assembly and onto the deck surface. Residual amounts of grease left on deck surfaces could contribute constituents to deck runoff. The survey team could not quantify the amount contributed to deck runoff by this equipment (Wenzel *et al*., 2001a).

The grease used on stores handling systems onboard AOE 6 Class vessels is continuously exposed to the elements and has the potential to contribute a significant amount of material to deck runoff. However, most of the grease would be deposited on the deck and the survey team

observed the crew constantly cleaning the deck surfaces during RAS operation. The survey team was unable to quantify the amount contributed to deck runoff by this equipment (Wenzel *et al*., 2001a).

Information regarding the potential discharge materials and narrative parameters for stores handling systems is presented in the following tables.

Table 5-17— Potential Discharge Materials for Stores Handling Systems

Potential Discharge Material	Potential Discharge Volume (gal/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (gal/fleet·yr)	Any BCCs Present?
Multipurpose Grease, MIL-G-24139A	Unknown	Petroleum hydrocarbons	—	Unknown	Unknown	Unknown
General Purpose Grease, MIL-G-23549	Unknown	Petroleum hydrocarbons	—	Unknown	Unknown	Unknown

Table 5-18—Narrative Parameters for Stores Handling Systems

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential exists
Hardness	Unknown-not evaluated
Nutrients	None
Odor	Unknown-not evaluated
Oil and Grease	Potential exists, none observed
Pathogens	None
PH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Would not change
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

The need for the information in this table was not recognized at the time of the assessment. The information is based on survey team recollection and consensus.

5.8 TOWING AND MOORING SYSTEMS

Most routine towing jobs in the Navy are handled by harbor and fleet tugs. Combatant vessels can tow other vessels or be towed, but such operations are usually performed only in an emergency. The towing rig varies between vessel classes, but generally includes the following components: the towing/padeye (usually located on the centerline of the stern), a towing assembly

(consisting of a large pelican hook shackled to the towing pad and hawser), and the hawser (wire rope) (Wenzel *et al*., 2001a).

Mooring a vessel to a pier, buoy, or another vessel requires the use of an anchor windlass: capstan: mooring lines: winches: fittings (e.g., cleats, bits, chocks, and shackles): and towing pads. Mooring lines are typically located at the bow, stern, and amidships. The survey team obtained towing and mooring system information during the AOE 6, DDG 51, MCM 1, WLM 175, and WPB 110 shipboard assessments. The crews perform all towing and mooring using multi-strand nylon line. No preservation measures are taken other than to inspect and replace the nylon line when required. Cleaning is limited to fresh or seawater rinses when required. As a result, the towing and mooring systems do not contribute to deck runoff (Wenzel *et al*., 2001a).

5.9 WEAPON SYSTEMS

The largest guns fitted on active Navy vessels are the 5 in MK 45 lightweight guns. These weapons are installed on cruisers and destroyers and are considered primarily shore bombardment weapons with limited anti-air capability. The 76 mm guns in Navy frigates and the larger USCG cutters are primarily anti-surface (shore and ship targets) weapons with limited anti-air capability. Most Navy surface warships are armed with the MK 15 20 mm Close-In Weapon System (CIWS) for short range defense against anti-ship missiles. In addition, Naval vessels are equipped with various types of 25 mm, 20 mm, .50-caliber, and 7.62 mm machine guns. These are primarily for defense against small craft in restricted waters. Weapon system information was obtained during surveys on the AOE 6, DDG 51, MCM 1, and WPB 110 Class vessels (Wenzel *et al*., 2001a). Three constituents may contribute to deck runoff during normal rainfall; MIL-G-21164D grease; MIL-L-63460D cleaner, lubricant and preservative; and MIL-PRF-680 Type III dry cleaning solvent.

5.9.1 AOE 6 Class

The AOE 6 Class has two MK 38 25 mm machine guns, four .50-caliber M2HP machine guns, two MK 15 CIWS, and one dual box missile launcher. All gun mounts are cleaned using freshwater and MIL-D-16791G general-purpose detergent. MIL-L-63460D cleaner, lubricant and preservative is applied to the .50-caliber gun mounts and the MK38 25 mm gun mount. The gun mounts are covered when not in use. However, the crew indicated that because the covers do not maintain integrity, rusting gun mount components is a continual problem. Because the weapon systems are covered and minimal materials are used to maintain the systems, they do not have the potential to contribute to deck runoff (Wenzel, 2000e).

5.9.2 DDG 51 Class

DDG 51 Class weapon systems include: one MK 45 5”/54-caliber lightweight gun mount, two MK 41 vertical launch systems (VLS), two MK 15 CIWS, two MK 32 MOD 14 triple-barrel torpedo tubes, two .50-caliber machine gun mounts, and two MK 36 MOD 12 Super Rapid-Blooming Offboard Countermeasures (SRBOC) chaff and decoy launching systems. The majority of materials, (e.g., grease and oils) that are used on the weapons systems are used on internal components and therefore do not have the potential to contribute to deck runoff. However, three materials used on the external surfaces of DDG 51 Class weapons systems were identified as having the potential to contribute to deck runoff: (1) MIL-G-21164D grease; (2)

MIL-PRF-680 Type III dry cleaning solvent; and (3) MIL-L-63460D cleaner, lubricant and preservative. Interviews with the crew revealed that approximately 30 % to 35 % of the 16 oz. of MIL-G-21164D that is applied to the gun mount chase is washed-off during a normal rainfall. The crew also estimated that approximately 50 % of the 2 oz of MIL-L-63460D cleaner, lubricant, and preservative applied to the .50-caliber gun mount is washed-off during a normal rainfall (Wenzel, 2000b).

5.9.3 MCM 1 Class

The MCM 1 Class vessels are equipped with two .50-caliber machine guns and two M60 machine guns. All gun mounts are cleaned using freshwater and a cleaning compound (Simple Green™). MIL-L-63460D cleaner, lubricant, and preservative is applied to the gun mounts. Covers are installed on the gun mounts when the vessel is in port to protect the equipment from the weather and to prevent corrosion (Wenzel, 2000c).

5.9.4 WPB 110 Class

The WPB 110 Class vessels are equipped with one MK38 25 mm machine gun and two .50-caliber M2HP machine guns. All machine guns are cleaned using freshwater and a cleaning compound (Simple Green™). Approximately 2 oz. of MIL-L-63460D cleaner, lubricant and preservative is applied to each .50-caliber gun mount and the MK38 25 mm gun mount. Covers are installed on the guns when the vessel is in port to protect the equipment from the weather and prevent corrosion (Wenzel 2000d). Because machine guns are covered when in port, the only constituent that has the potential to contribute to deck runoff is MIL-L-63460D. However, the potential only exists if the vessel is operating in the contiguous zone during rainfall or heavy seas (Wenzel *et al*., 2001a).

5.9.5 Summary of Petroleum, Oil, and Lubricants for Weapon Systems

The survey team concluded that other than the 5”/54-caliber lightweight gun mount and the .50-caliber gun mount, weapon systems do not contribute to deck runoff (Wenzel *et al*., 2001a). The weapon system information is detailed in the following table.

Table 5-19— Potential Weapons Systems Constituents by Vessel Class

Vessel Class	**Weapon System**	**Potential Discharge Material**
AOE 6	MK 38 25 mm machine guns (2)	Cleaner, lubricant, and preservative MIL-L-63460D
AOE 6	CIWS (2)	Cleaner, lubricant, and preservative MIL-L-63460D
AOE 6	M2HP .50-caliber machine guns (4)	Cleaner, lubricant, and preservative MIL-L-63460D
DDG 51	MK 45 5"/.54-caliber lightweight gun mount (1)	Grease, MIL-G-21164D
DDG 51	MK 41 vertical launch system (2)	None
DDG 51	MK 32 MOD 14 triple barreled torpedo launcher (2)	None
DDG 51	CIWS (2)	Cleaner, lubricant, and preservative MIL-L-63460D
DDG 51	M2HP .50-caliber machine gun (2)	Cleaner, lubricant, and preservative MIL-L-63460D
MCM 1	M2HP .50-caliber machine gun (2)	Cleaner, lubricant, and preservative MIL-L-63460D
WPB 110	MK 38 25MM rapid fire, fixed mount (1)	Cleaner, lubricant, and preservative MIL-L-63460D
WPB 110	M2HP .50-caliber machine gun (2)	Cleaner, lubricant, and preservative MIL-L-63460D

Based on ship survey evaluations and crew estimates, the fleet-wide discharge of MIL-G-21164D grease from the MK 45 5"/.54-caliber lightweight gun mount is calculated as follows (Wenzel *et al*., 2001a).

1. Approximately 5.0 oz of grease is released during each typical rain event.
   (16 oz/unit × 30 %/event = 5.0 oz/unit-event)

2. A weapon unit that is exposed to 24 typical rain events per year would generate an estimated annual grease release of 120 oz.
   (24 events/yr × 5.0 oz/unit-event = 120 oz/unit·yr)

3. With 228 heavy weapon units in the fleet (166 of the 5"/54 guns and 62 of the MK 75 guns), the annual fleet-wide grease release is estimated to be 27,000 oz.
   (120 oz/unit·yr × 228 units/fleet = 27,000 oz/fleet·yr)

4. Based on a fleet wide average of approximately 50 % time spent pierside or transiting within 12 nm, the grease released within 12 nm is estimated to be 13,500 oz.
   (27,000 oz/fleet·yr × 50 % = 13,500 oz/fleet·yr)

The fleet-wide discharge of MIL-G-63460 grease from the .50-caliber gun mount is calculated as follows (Wenzel *et al*., 2001a):

1. Approximately 1 oz of grease is released during each typical rain event.
   (2 oz/unit × 50 %/event = 1 oz/unit-event)

2. Assuming 24 rain events per year, the annual per weapon unit grease release is estimated to be 24 oz.
   (24 events/yr × 1 oz/unit-event = 24 oz/unit·yr)

3. With 416 total weapon units in the fleet, the annual fleet-wide grease release is estimated to be 10,000 oz.

(24 oz/unit·yr × 416 units/fleet = 10,000 oz/fleet·yr)

4. Based on a fleet-wide average of 50 % of time at pierside or transiting within the 12 nm, grease released is estimated to be 5,000 oz/fleet·yr.
(10,000 oz/fleet·yr × 50 % = 5,000 oz/fleet·yr).

Table 5-20— Potential Discharge Materials for Weapon Systems

Potential Discharge Material	Potential Discharge Volume (oz/fleet·yr)	Bulk Constituents	CAS #	Composition (%)	Constituent Mass Loading (oz/fleet·yr)	Any BCCs Present?
Grease, MIL-G-21164D	1.4E+04	Synthetic ester	—	> 74	> 1.0E+04	None
		Lithium based soap thickener	—	> 12	> 1.6E+03	None
Cleaner, lubricant and preservative, MIL-L-63460D	5.0E+03	Unknown	—	Unknown	Unknown	Unknown
Dry Cleaning Solvent 6850-00-274-5421 (MIL-PRF-680 Type III)	Unknown	High purity hydrocarbon solvents	—	100	Unknown	Unknown

Table 5-21—Narrative Parameters for Weapon Systems

Narrative Parameters	Survey Team Observations
Alkalinity	Unknown-not evaluated
BOD/DO	Unknown-not evaluated
Colloidal Matter	Unknown-not evaluated
Color	Unknown-not evaluated
Floating Material	Potential exists
Hardness	Unknown-not evaluated
Nutrients	None
Odor	Unknown-not evaluated
Oil and Grease	Potential exists, none observed
Pathogens	None
pH	Unknown-not evaluated
Settleable Materials	Unknown-not evaluated
Specific Conductance	Unknown-not evaluated
Suspended Solids	Unknown-not evaluated
Taste	Unknown-not evaluated
Temperature	Would not change
Total Dissolved Gases	Unknown-not evaluated
Turbidity/Colloidal Matter	Unknown-not evaluated

The need for the information in this table was not recognized at the time of the assessment. The information is based on survey team recollection and consensus.

5.10 PERFORMANCE OBJECTIVE AND ACTIVITIES

The objective of the TMP for this category is for the vessel's responsible party to prevent the discharge of cleaning compounds, greases, hydraulic fluids, solvents, oils, fuels, and other materials associated with deck machinery and weapons lubrication that may negatively impact water quality. Activities that could be performed to meet this performance objective include, but are not limited to: using a wire rope lubricator and using covers or protective devices.

Currently, some vessels use rags to apply and remove grease from cables. This process results in the application of excessive grease that then has the potential to fall to the deck. Although grease deposits are cleaned up upon discovery, some grease can become trapped in the rough deck surface and contribute to deck runoff. This activity consists of using a wire rope lubricator to remove and apply grease to cables (Kirkpatrick, 1999). The wire rope lubricator applies grease under pressure to drive out moisture-contaminated old grease from internal and external wire strands and scrapes off this used grease using a groove cleaner (Kirkpatrick, 1999). The used grease is deposited in a bucket located under the scraper, where it can be containerized for proper disposal (Kirkpatrick, 1999). Using a wire rope lubricator reduces the amount of excessive grease because the grease is primarily applied to the internal sections of the wire rope, not the exterior. Reducing the amount of surface grease reduces the amount of grease that has the potential to fall off onto the deck and subsequently contribute to deck runoff.

Grease applied to deck machinery and weapons contribute to deck runoff. Using weatherproof covers or protective devices prevents grease and oil from falling or being blown or washed to the deck or directly overboard, therefore reducing the amount of grease and oil that may contribute to deck runoff. Examples of activities that use covers or protective devices are as follows:

Installing chafing guards at friction points on exposed hydraulic hoses prevents chafing of hydraulic hoses therefore minimizing leaks from these hoses.

Installing extensions on winch engine oil drains enables the crew members to drain the dirty oil directly into a container, facilitating a more efficient oil collection and minimizing the potential for a spill.

Installing weatherproof, form fitted covers with fasteners (zippered or snap) on cranes and weapons systems would reduce the exposure of grease and hydraulic fluid to rain and seawater, thereby reducing the contribution of grease and hydraulic fluid to deck runoff.

Installing sample fittings on winch engines would allow crew members to collect samples of hydraulic fluid without disturbing the integrity of the hydraulic system. Because the crew member does not have to disconnect any hydraulic lines to obtain the actual sample, the potential contribution of hydraulic fluid to deck runoff is reduced.

Finally, using tarps (stored below decks when not in use) during routine maintenance of deck machinery and weapons systems prevents the grease and oil from falling to the deck where they may contribute to deck runoff both inside and outside 12 nm.